Convergent continental margins are the primary host of both growth and loss of continental crust. Continental growth largely occurs via subduction-driven magmatism, whereas continental loss largely occurs via subduction erosion and sediment subduction. Because the latter typically involves partial recycling into magmas, both growth and loss of continental crust can be represented in the magmatic record. The degree of crustal recycling can be estimated from the initial Hf isotope signatures in both magmatic and detrital zircon grains. Recent insights into the geodynamic evolution of the Peruvian margin, in combination with a new dataset of Hf isotopic data on zircon from the Carboniferous to Early Cretaceous, enable us to (1) compare the geodynamic history of the southern Peruvian margin with its Hf isotopic evolution, and (2) quantify the crustal growth between 500 and 135 Ma. The data exhibit a correlation with trends in isotope composition v. time and reflect the dominantly extensional regime that prevailed from the onset of subduction from 530 Ma to c. 135 Ma. This study demonstrates that the Peruvian margin experienced continental growth with juvenile input to arc magmatism of 30–45% on average, and illustrates the use of U–Pb and Hf isotopes in zircon as a tool to trace episodes of crustal growth through time. Supplementary material: Hf istopic analyses on zircon (A1 and A2) and new U–Pb zircon ages (A3) are available at http://www.geolsoc.org.uk/SUP18661